AN OBSERVATIONAL STUDY TO FIND OUT RELATION BETWEEN PRAKRITI (AYURVEDA CONSTITUTION) AND HEALTH RELATED PHYSICAL FITNESS

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ABSTRACT

Background: *Ayurveda,* the Indian traditional system of medicine designates a novel concept *"Prakriti"* the genetically determined system that categorises the population into phenotypic groupings with specific characters like physique, temperament and behaviour. The contemporary science of genomics, individualised medicine as well as*Ayurveda* has inspired scholars to evaluate relation between*Prakriti*(Ayurveda constitution)and various objective parameters. The aim of present study was to evaluate the correlation between *Prakriti*(Ayurveda constitution) and health related physical fitness. The objective of study was to assess sharir Prakriti and health related physical fitness of study participants.

Method: After obtaining Institutional Ethics Committee permission, normal healthy individuals of either sex (age group 22 to 35 years) were recruited in the study. Their *Prakriti*(Ayurveda constitution) evaluation was done using a standardized validated questionnaire and software (Ayusoft C-DAC). Their health related physical fitness was assessed by thereliable, valid and field based set of ALPHA-FIT fitness test battery. Pearson's correlation coefficient (r) was calculated to study the association between *Prakriti*(Ayurveda constitution) and fitness factors.

Results: We observed that, in the study population (n=50), statistical analysis (Pearson's correlation test) showed significant positive correlation between *Kapha* dominant constitution and health related physical fitness while no significant correlation between health related physical fitness and *Vata* and *Pitta* dominant constitution.

Conclusion: Results of the study indicate that identifying the *Prakriti*(*Ayurveda* constitution) may help in categorising the population on the basis of physical strength and fitness.

Keywords: *Prakriti*(*Ayurveda* constitution), Health related physical fitness, the ALPHA-FIT test battery, *Vata, Pitta, Kapha*.

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INTRODUCTION -

Ayurveda, India's natural health care tradition designates a novel concept "Prakriti" (Ayurveda constitution) that genetically determined[1] and classifies the population into phenotypic groupings with specific characters like physique, temperament and behaviour.[2,3] The constitutional characteristics of an individual correspond to predominance of dosha. Ayurveda classics quantify the three dosha viz. Vata, Pitta and Kapha. The Vata dosha is responsible for various movements (respiration, musculoskeletal activities, natural urges, enthusiasm etc).[4]The Pitta dosha is responsible for digestion, metabolism, vision, intelligence, heat production, softness and suppleness of body etc.[5] The Kapha dosha is anabolic in nature and responsible for physical phenomena as production of bodily strength and build, integration of structural elements of body, the maintenance of the smooth working of joints, courage, zest and virility etc.[6]

The Prakriti(Ayurveda constitution) is named according to predominance of dosha in ratio of either single, double or all the three together with major three types of constitution as Vata, Pitta and KaphaPrakriti.[7]The predominance of dosha is decided at the time of fertilization and influenced by lifestyle of mother, internal environment of womb and nature of gametes. The Prakriti(Ayurveda constitution)represents classical physical, physiological and psychological characteristic features according to attributes of dominant dosha. For instance, person of Kapha constitution possess firmness, compactness of the body, a stable gait, excellent strength etc.[8] Individuals with Pitta constitution have medium body frame, looseness and softness of joints and muscles, moderate strength etc[9]whereas individuals with Vata constitution have emaciated tall or dwarf body, inconsistent gait, unstable joints, possess strength in lesser quantity etc.[10]

The contemporary science of genomics, individualised medicine and Ayurveda have inspired scholars to evaluate relation between Prakriti (Ayurveda constitution) and various objective parameters as Harvard step test (cardiorespiratory fitness index)[11], hand dynamometer (upper extremity strength)[12], height–arm span[13],cardio-vascular exercise capacity etc.[14]The present study was aimed to evaluate the relation between Prakriti(Ayurveda constitution) and health related physical fitness. We hypothesized that, individual having Kapha predominant body constitution may not be endowed with good health related physical fitness.The objective of study was to assess Sharir Prakriti and health related physical fitness of study participants.

Good health related physical fitness indicates that person possess good ability to complete his routine activities as well as leisure activities with vigour and enables him to resist risk of development of various metabolic disorders regarding hypo activity.[16]Health related physical fitness consist of five health components as body composition, muscular strength, muscular endurance, cardio-respiratory fitness and flexibility.[17]Assessment of these components with reliable and valid parameter gives idea regarding the functional status of various body systems such as cardio-respiratory, musculoskeletal system, nervous system, endocrine system etc.[18]

The ALPHA-FIT test battery for adults is one of reliable, valid and easily applicable field based set of tests used for assessment all components of health related physical fitness of adults.[19] It consists of various field based assessment tests explained thoroughly with standard operating procedures and utilising evidence based instruments. This tool also helps to categorize individuals as per risk of cardiovascular disease or obesity. In present study, we examined Prakriti (Ayurveda constitution) of healthy participants by using valid questionnaire (Ayusoft C-DAC) and assessed their health related physical fitness with the ALPHA-FIT test battery for adults.

MATERIAL AND METHODOLOGY -

This cross sectional observational study, participants who met inclusion criteria from the College of Ayurved, Bharati Vidyapeeth (Deemed to be University), Pune were enrolled.The aim and procedure of research study was explained thoroughly to the participants and informed consent was obtained in bilingual consent form. The Institutional Ethics Committee of Post Graduate Teaching and Research Institute, College of Ayurved, Bharati Vidyapeeth Deemed to Be University, Pune approved the study as a component of the Ph.D. programme.(Ref No: BVDUCOA/EC/1303).The CTRI registration number for trial is CTRI/2020/07/026554.

STUDY DESIGN -

Place of Study-Bharati Vidyapeeth Deemed University, College of Ayurved, Pune.

Inclusion Criteria -

1. Healthy male and female subjects.
2. Age group - 22-35 years.

Exclusion Criteria -

1. Subject suffering from any major physical, cardiovascular, musculoskeletal, and psychological or any other systemic illness.
2. Pregnant and lactating women.
3. Subjects which are physically handicapped.
4. Subjects performing exercise or gym workouts regularly.

A) Assessment of Prakriti (Ayurveda constitution) - In this study, for assessment of Prakriti (Ayurveda constitution), a validated questionnaire and software was used. This was done by pro-forma and software designed by C-DAC (Centre for Development of Advance Computing-A scientific society of The Ministry of Communications and Information Technology, Gov. of India). A validated questionnaire and interview method was used for assessment of characteristic features of the dosha dominance. The data collected and fed to software to get percentage score of dosha and type of Prakriti of participant was derived according to dominant dosha. The percentage score of dosha derived from software was further considered for statistical analysis.

B) Health related physical fitness - Health Related Physical fitness of study participants was assessed by utilizing protocol of ALPHA-FIT test battery for adults. A standard pre-test health screening was carried out to ensure safe testing. Participants were instructed to wear t-shirt, short trouser and sports shoes or other comfortable low heel shoes during fitness testing. Fitness test performance was conducted in standardised order to get valid and reliable test results. Table no. 1 represents fitness components, factors and fitness tests conducted as per ALPHA-FIT test battery.

Table 1 – Description of ALPHA –FIT Test Battery

Sr. No.	Fitness Component	Fitness Test	Fitness Factor
1.	Body Composition	1.1 Body Mass Index	Obesity
		1.2 Waist circumference	Abdominal Adiposity
2.	Motor Fitness	2.1 One-leg stand	Balance
		2.2 Shape-of-Eight Run	Agility

3.	Musculoskeletal Fitness	3.1 Hand grip	Upper body muscular strength
		3.2 Jump and Reach	Lower body muscular strength
		3.3 Modified push-up	Muscular endurance of trunk
4.	Cardiorespiratory Fitness	4.1 Two Kilometre Walk	Aerobic capacity and capacity of brisk walking

STATISTICAL ANALYSIS –

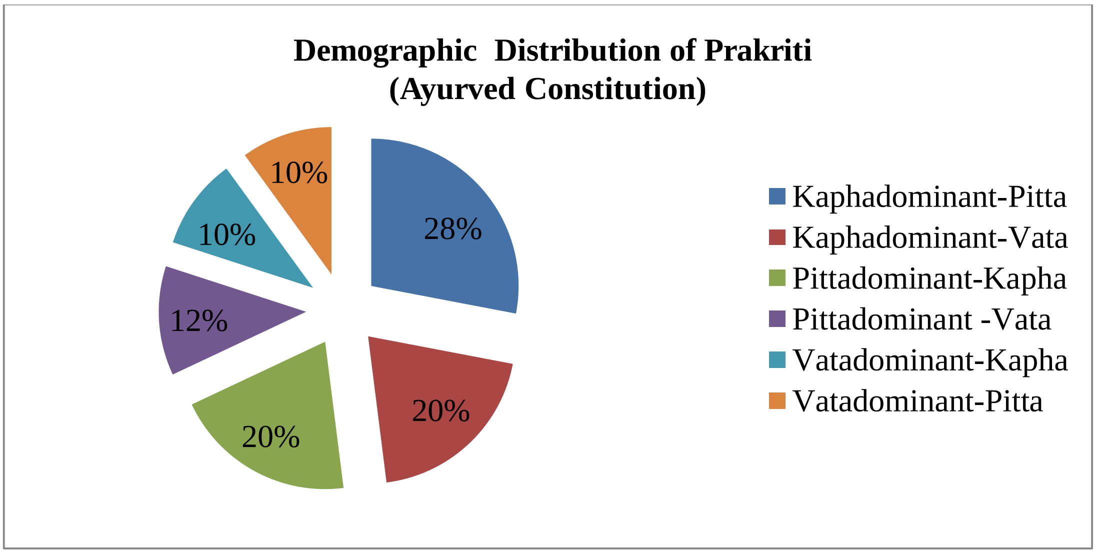
The data presented as demographic distribution of Prakriti (Ayurveda constitution) of study participants as well as means and standard deviations for health related physical fitness test variables. Statistical significance was set at $p<0.05$. The association between Prakriti (Ayurveda constitution) and health related physical fitness score was calculated by using Pearson's correlation coefficient (r).

RESULT –

a) Prakriti (Ayurveda constitution)- Table 2 represents demographic distribution of Prakriti of study participants.

Table 2 – Demographic Distribution of Prakriti (Ayurveda constitution)

Prakriti (Ayurveda constitution)	**Number of Participants**	**Percentage**
Kapha dominant -Pitta	14	28.00
Kapha dominant -Vata	10	20.00
Pitta dominant -Kapha	10	20.00
Pitta dominant -Vata	06	12.00
Vata dominant -Kapha	05	10.00
Vata dominant -Pitta	05	10.00
Total	50	100.00



b) Health related physical fitness - This study represents data of mean values and standard deviation calculated gender wise for height, weight, BMI, waist circumference, one leg stand test, figure of eight run, hand grip test, jump and reach test, modified push up test, 2 km walk test time duration and Vo_{2max}. The data is represented in table 3.

Table 3 - The Descriptive Statistics for Health Related Fitness Test Variables

Health Related Fitness Test Variables	**Men (*X*±SD) n =25**	**Women (*X*±SD) n=25**
Height (cm)	171.32 ± 5.54	157.83 ± 4.87
Weight(kg)	65.25 ± 7.73	52.25 ± 5.95
BMI	22.26 ± 2.77	20.9 ± 2.11
Waist Circumference (cm)	85.73 ± 7.18	74.08 ± 5.94
One leg stand test (sec)	59.57 ± 1.79	59.70 ± 1.08
Shape of eight run (sec)	7.6 ± 0.62	8.01 ± 0.68
Hand grip test (kg)	40.56 ± 5.30	23.85 ± 2.49
Jump and reach test (cm)	33.56 ± 6.73	24.54 ± 2.81
Modified push up test (No.)	11.96 ± 2.89	10.66 ± 2.20
2 km walk test (min:sec)	19.11 ± 1.76	21.24 ± 1.45
VO_{2max}	86.47 ± 14.80	77.37 ± 12.94

In present study, participants show normal BMI with mean of 22.26 ± 2.77 for men and 20.9 ± 2.11 for women. Out of 25 men; 5 men show waist circumference above 90cm and were classified as having moderated risk of cardiovascular disease. Female participants show normal waist circumference with mean 74.08 ± 5.94. Almost all participants performed well in one leg stand test and completed the duration of 60 seconds. Mean value of shape of eight run test for men was 7.6 (± 0.62) seconds and for female 8.01 (± 0.68) seconds. Mean value of hand grip in men (40.56 ± 5.30) observed higher to mean value in women (23.85 ± 2.49). Mean value of jump and reach test in men (33.56 ± 6.73) observed higher to mean value in women (24.54 ± 2.81). Similarly mean value of modified push up in men (11.96 ± 2.89) observed higher to mean value in women (10.66 ± 2.20). Men (19.11 ± 1.76 min:sec) finished 2km walk test earlier compared to women (21.24 ± 1.45 min:sec). Mean value of VO_{2max} in men (186.47 ± 14.80) observed higher to mean value in women (77.37 ± 12.94).

C) Association of health related physical fitness with Prakriti (Ayurveda constitution) – Findings of this cross sectional observational study are indicated in table 4, 5, 6 and 7 by computing Karl Pearson's correlation coefficient (r) to evaluate the association of Prakriti (Ayurveda constitution) with health related physical fitness. Pearson's correlation coefficient (r) interpreted as strength of association is strong positive if r value 0.5 to 1.0, medium positive if r value 0.3 to 0.5 and small positive if r value 0.1to 0.3. Similarly strength of association is strong negative if r value -0.5 to -1.0, medium negative if r value -0.3 to -0.5 and small negative if r value -0.1 to -0.3.

Table 4 - Association of Body Composition with Prakriti (Ayurveda constitution)

Body Composition Tests	**Statistical Analysis**	**Prakriti (Ayurveda constitution)**		
		Vata	**Pitta**	**Kapha**
BMI – Obesity	Pearson Correlation Coefficient (r)	-0.741	-0.178	0.728
	P-Value	0.000	0.058	0.000
Waist Circumference (cm) – Abdominal obesity	Pearson Correlation Coefficient (r)	-0.381	-0.248	0.497
	P-Value	0.000	0.008	0.000

Pearson's correlation coefficient (r) showed significant strong positive correlation between BMI and Kaphadominant constitution while strong negative strength of association with Vata dominant constitution and no significant correlation with Pittadominant constitution.

Pearson's correlation coefficient (r) showed significant medium positive correlation between waist circumference and Kaphadominant constitution while small negative strength of association with Pitta dominant constitution andVata dominant constitution.

Table 5 - Association of Motor Fitness with Prakriti(Ayurveda constitution)

Motor Fitness Tests	**Statistical Analysis**	**Prakriti (Ayurveda constitution)**		
		Vata	**Pitta**	**Kapha**
One Leg Stand Test (sec) - Balance	Pearson Correlation Coefficient (r)	-0.152	-0.063	0.171
	P-Value	0.106	0.505	0.068
Shape of Eight Run(sec) – Agility	Pearson Correlation Coefficient (r)	-0.491	-0.158	0.516
	P-Value	0.000	0.092	0.000

Pearson's correlation coefficient (r) value showed significant small positive correlation between balance fitness factor (one leg stand test) and Kaphadominant constitution while small negative strength of association with Vata dominant constitution and no significant with Pittadominant constitution. Pearson's correlation coefficient (r) value showed significant medium positive correlation between agility fitness factor (figure of eight run) and Kaphadominant constitution while medium negative strength of association with Vata dominant constitution and no significant correlation with Pittadominant constitution.

Table 6 - Association of Musculoskeletal Fitness with Prakriti (Ayurveda constitution)

Health Related Physical Fitness Tests	**Statistical Analysis**	**Prakriti (Ayurveda constitution)**		
		Vata	**Pitta**	**Kapha**
Hand Grip (Kg) – **Upper body muscular strength**	Pearson Correlation Coefficient (r)	-0.484	-0.323	0.638
	P-Value	0.000	0.000	0.000
Jump and Reach(Cm) - Lower body muscular strength	Pearson Correlation Coefficient (r)	-0.262	-0.199	0.368
	P-Value	0.005	0.033	0.000
Push ups (Number) - Muscular endurance of trunk	Pearson Correlation Coefficient (r)	-0.469	-0.378	0.669
	P-Value	0.000	0.000	0.000

Pearson's correlation coefficient (r) showed significant strong positive correlation between upper body muscular strength (hand grip) and Kaphadominant constitution while medium negative strength of association with Pitta dominant constitution andVata dominant constitution. Pearson's correlation coefficient (r) showed significant medium positive correlation between lower body muscular strength (jump and reach test) and Kaphadominant constitution while small negative strength of association with Pitta dominant constitution andVata dominant constitution. Pearson's correlation coefficient (r) value showed significant strong positive correlation between muscular endurance of trunk (push ups) and Kaphadominant constitution while medium negative strength of association with Pitta dominant constitution andVata dominant constitution.

Table 7 - Association of Cardiorespiratory Fitness with Prakriti

(Ayurveda constitution)

Health Related Physical Fitness Tests	**Statistical Analysis**	**Prakriti (Ayurveda constitution)**		
		Vata	**Pitta**	**Kapha**
2 km Walk - Time (min.sec)	Pearson Correlation Coefficient (r)	0.323	0.283	-0.580
	P-Value	0.000	0.002	0.000
$VO_{2\ Max}$	Pearson Correlation Coefficient (r)	-0.290	-0.267	0.545
	P-Value	0.002	0.004	0.000

Pearson's correlation coefficient (r) value showed significant strong negative correlation between time required to complete 2km walk test and Kaphadominant constitution while small strength of association observed between with Vata dominant constitution and Pittadominant constitution. Pearson's correlation coefficient (r) value showed significant strong positive correlation observed between VO_{2max} and Kapha dominant constitution while small negative strength of association with Pitta dominant constitution and Vata dominant constitution.

DISCUSSION -

Prakriti (Ayurveda constitution) is one of distinctive concept of Ayurved which affects each and every factor that individual encounter from intrauterine life till death.It represents body in terms of dominant dosha. Assessment of Prakriti (Ayurveda constitution) is one of best tool which explores complete constitutional makeup of the individual and helps to know the individual better with all the aspects.

In present study, assessment of Prakriti (Ayurveda constitution) of fifty healthy participants was conducted by using reliable and valid questionnaire designed by Ayusoft – C DAC i.e. Centre for development of advance computing and supported by interview method. Percentage distribution of dosha derived from software was considered for statistical analysis and result of study was interpreted in terms of dominant dosha.

In this study, Kapha dominant body constitution showed statistically significant positive correlation with body composition component whilePitta dominant constitution andVata dominant constitution showed small negative strength of association with it.

In view of contemporary science, body composition is a physical characteristic of health related physical fitness that refers to the ratio of fat to the body's lean mass.[20] Adequate body composition is essential for optimal health and sporting activities. Excess adipose tissue above the optimal level is prone to increased risk of obesity, cardiovascular disease, diabetes and malignant diseases[21] as well as prevents sportsperson from excellent performance in various sporting activities.[22]

According to Ayurved classics,Kapha dominant body constitution individuals possess well built, compact, stable, proportionate body.[23,24] Their muscles are well nourished, well-toned and compact; joints are compact, firm, well covered with tendons. Pitta dominant constitution individuals possess delicate body parts, lax and soft muscles, lax and flexible joints.[23,24]Vata dominant constitution individuals are thin built, non-muscular; possess lax, unstable joints which produces crackling sound during movements.[23,24] Hence individuals with Kapha dominant body constitution may be endowed with good body composition as compared to Pitta and Vata dominat individuals.

In view of motor fitness, all study participants completed the duration of sixty seconds of one leg stand test (balance fitness factor). There was significant small strength of association within balance fitness factor and Kapha and Vata dominant body constitution. Balance is the quality to control body position during motion or static situation and adjust it according to change in centre of gravity.[17,25] Athlete with high level of static and dynamic balance is able to keep body in appropriate posture or in upright position despite of obstacles.[26] In older persons, falls that caused by poor postural control may lead to osteoporotic fractures.[27,28] Middle age individuals with back pain often have impaired postural control.

In case of agility fitness factor, Vata dominant constitution showed significant negative strength of association while Kapha dominant constitution showed significant positive correlation. On the other hand Pitta dominant constitution showed no significant correlation with both balance and agility fitness factors of motor fitness. Agility is the ability to quickly swap the position of whole body in space with speed and accuracy.[17] Agility is key factor in various sports like badminton, basketball, football where agile athlete move body either by speeding up, slowing down or changing direction. Agility is also important to prevent falls and thereby musculoskeletal injuries.[29]

Individuals with Kapha dominant constitution may be able to maintain the postural control during quick motion or in static position as they are endowed with well built, stable, compact body. Pitta dominant individuals possess lax, soft muscles and joints while Vata dominant individuals are lean, non-muscular with unstable joints. Hence individuals with Kapha dominant body constitution may be endowed with good motor fitness as compared to Pitta and Vata dominant individuals.

In context of musculoskeletal fitness, Kapha dominant body constitution showed statistically significant positive correlation with muscular strength and endurance whilePitta dominant constitution andVata dominant constitution showed significant negative strength of association with it. Musculoskeletal fitness is a multifaceted construct that represents the integrated function of neuromuscular and musculoskeletal system. Muscle strength is the ability of a muscle or group of muscle to exert or to apply maximum force against the resistance in single effort for short duration.[17] Muscular endurance is capability of muscle or group of muscle to exert force against resistance with repeated contraction for prolong period.[17]High levels of musculoskeletal fitness are associated with positive health status, and low levels of musculoskeletal fitness are associated with lower health status.[30]Musculoskeletal fitness is associated with many health benefits such as increased bone mineral density, increased flexibility, improved glucose tolerance, and completion of activities of daily living with vigour.[31]

According to Ayurved classics,Kapha dominant constitution being excellent physical properties shows positive impact on their strength and fitness. Such individual are endowed with good physical strength and even capable of withstanding physical stress and difficulties. Pitta dominant constitution possesses moderate strength and less tolerant towards laborious work. Vata dominant constitution possesses physical strength in lesser quantity. Hence Kapha dominant individuals may have excellent musculoskeletal fitness compared to Pitta and Vata dominant individuals.

In context of cardiorespiratory fitness, Kapha dominant constitution participants completed the 2 kilometre walk test early compared with others and showed significant positive correlation with $VO_{2max.}$ Vata and Pitta dominant constitution showed negative correlation with $VO_{2max.}$ Cardiorespiratory fitness is the ability to perform large-muscle, whole-body exercise at moderate to high intensities for extended periods of time.[17] Here body's cardiovascular and respiratory systems function together, especially during exercise or work, to ensure that adequate oxygen is supplied to the working muscles to produce energy.[32] VO_{2max} i.e. maximum rate of oxygen uptake is benchmark for assessment of cardiorespiratory fitness.[33] It represents individual’s ability to utilise oxygen in greatest amount to produce ATP aerobically. VO_{2max} is aerobic power which results due to integration of respiratory, circulatory and neuromuscular system.

Kapha dominant constitution is endowed with great strength and capable to work hard. They are graced with well-nourished and fully developed organs. Pitta dominant constitution possesses lax body parts. They sweat profusely. They are intolerant to heat and physical labour. Vata dominant constitution possesses thin built, small sized body parts, unstable joints, unsteady gait and less tolerance power. Hence Kapha dominant individuals may have excellent cardiorespiratory fitness compared to Pitta and Vata dominant individuals.

Further research can be conducted on large sample size that will explore the range of health related physical fitness of population and impact of dominant dosha on it. It will be helpful to know impact of habitat, seasonal variations, food habits, occupations etc. on body constitution and physical fitness.

CONCLUSION -

Prakriti (Ayurveda constitution) is useful to categorise the individuals on basis of physical strength and fitness. Statistical analysis (Pearson's correlation test) showed that there is significant positive correlation between Kapha dominant constitution and health related physical fitness as well as according to statistical analysis there is no significant correlation between health related physical fitness and Vata dominant and Pitta dominant constitution.

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AUTHORS CONTRIBUTION -

Dr. Sharayu P. Phule , Dr. Umesh S. Ghate : methodology, detail review and editing

Dr. Sharayu P. Phule ,Dr. Ganesh B. Patil: validation,data analysis,supervision

All authors interpreted the results and critically revised the manuscript for scientific content

All authors approved the final version of the article

CONFLICT OF INTEREST -

The authors declare that there is no conflict of interest.

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